Washington State
Department of Transportation

# Memorandum

August 10, 2010

TO: Will Smith
South Central Region, DOTSC

FROM: Tony Allen/ Steve Lowell
E & EP Geotechnical Division, 47365

SUBJECT: I-90 Hyak to Snowshed Vicinity – Phase 1B, Contract 7852

We have reviewed the letters received from Kuney General Contractor's Serial Letter No 80-11 (dated July 27, 2010 and KLB Construction's Serial Letter No. 52 (dated July 26, 2010 in which the contractors claims delays to the work ***"due to the untimely addition of rock dowels at Jenkins Knob"*** (Kuney's 4/26/10 letter). Jenkins Knob is located in the Station 1337 rock cut that the contractors are currently working on. In addition, the contractors are claiming that this issue ***"is primarily due to a lack of consistent geotechnical representation on the project. This lack of presence has adversely affected construction activities more than once. I am therefore requesting that a geotechnical representative be on site whenever work is progressing on the slope."*** (Kuney's 4/26/10 letter). A copy of these letters are attached to this memorandum. Subsequent to the issuance and in response to these letters we have been verbally requested by your office, on July 28, 2010, to provide full time, dedicated, on-site geotechnical representation on the project. The purpose of this memorandum is to respond back to the contractor's claims.

## Backgound

The earthwork portion of the Phase 1B project consists of new cut slopes for virtually the entire length of the project. The geotechnical design for the project concluded that rock cuts with station intervals westbound of Jenkins Knob (vic. Sta. 1330) would require flatter rock cuts (1/2:1) and extensive stabilization due to marginal quality volcanic and sedimentary rock. The rock cuts eastbound of Jenkins Knob were designed be cut at a traditionally steep slope (1/4:1) provided that slope reinforcement is integrated in the construction of these slopes. The extensive and detailed geotechnical report prepared by Wyllie and Norrish Rock Engineers, Inc. (March 2009) stated the following:

> "Successful excavation and long term performance of the proposed rock cut slopes will require that stabilization measures be installed as all cuts are brought down. This will require close coordination between owner and contractor and to some extent will restrict the efficiency of rock excavation.

> Rock conditions in volcanic terrain are highly variable and defy accurate characterization, irrespective of drilling and mapping intensity. Provisions must be made to make design changes to rock slopes during excavation as actual conditions are encountered. Such changes will primarily relate to types and/or frequency of stabilization measures such a dowels, rock bolts, and shotcrete. Site geotechnical engineering during construction coupled with predictive slope displacement monitoring are recommended to recognize and mitigate slope instability in a timely manner."

These two statements were included in the Summary of Geotechnical Conditions for the project, and made part of the contract as Appendix I of the Special Provisions.

The Phase 1B project contains approximately 3500 feet of rock cuts with maximum cut heights on the order 120 to 125 feet, with overburden removal required for most of the rock cuts. The rock cuts contain potentially adversely oriented geologic structure in the form of planar and wedge features that could cause potential instability within the final cut face. To that end, WSDOT prepared contract documents (plans and specification) which detailed, to the extent possible, the scope and magnitude of the overburden removal and the rock slope excavation and stabilization work. The contract provided for Type L rock dowels (passive 60 kips capacity), Type L rock bolts (post-tensioned 50 kips capacity), Type H rock bolts (post tensioned 120 kips capacity), horizontal rock drains, and fiber-reinforced shotcrete items in the contact. Prescriptive stabilization work has been specified in the contract documents at specific locations. The contract also provides for rock dowel, rock bolt, fiber-reinforced shotcrete and horizontal drain rock installation at locations designated by the Engineer, based on geological conditions encountered in the cuts. In addition, a monitoring prism system and monitoring stain gage system were specified to provide near real-time slope monitoring capabilities as the rock cuts were being brought down to grade.

## Phase 1B Geotechnical Construction Support

The WSDOT Geotechnical Division is a full service geotechnical organization responsible for the geotechnical design and construction support, statewide, for all WSDOT projects on an as-needed basis. On the Phase 1B project the geotechnical support is focused primarily on the stability of the final rock slope as it is being brought down to grade. The Geotechnical Division has established a team of highly qualified senior level and project level geotechnical, instrumentation and blasting experts to provide the geotechnical construction support for this project. Our geotechnical efforts are focused in the following areas:

**Review of Existing Data**
During the design phase of this project, extensive surficial geologic mapping, test boring, downhole optical tele-viewer surveys, and Siro-Vision surveys of the existing slopes were conducted to characterize the geologic structure that could impact the stability of

the proposed rock cuts. This geotechnical work has resulted in a rich database of geotechnical information that we have incorporated into our geotechnical construction support activities for this project. We are utilizing this geotechnical data for rock cuts that are in progress to re-check geotechnical issues that were identified in the design phase of this project. We are employing newer computer technology to project geologic structure data into the proposed excavation face in an attempt to identify adverse geologic conditions in advance of the excavation.

**Geotechnical Instrumentation**

A critical component of our geotechnical construction support program for this project is the utilization of a survey prism monitoring and a strain gage monitoring system which were specified in the contact. The components for these systems are supplied, built, and maintained by the contractor. The intent is to provide near real-time information on slope movement over the course of the construction contract. The data that is generated by these systems are routinely monitored and reviewed by our geotechnical team.

**Lift Inspections**

The purpose of the geotechnical lift inspection is to field review the newly exposed rock slope to visually identify any potential adversely oriented geologic structure and their spatial relationship to the final slope that could cause instability in the rock cut, and to provide recommendations to stabilize these structures. Typically this stabilization will be in the form of passive rock dowels, post-tensioned rock bolts, fiber-reinforced shotcrete, and horizontal rock drains (existing bid items in the contract). It is critical that the newly excavated slope area is sufficiently large enough to reveal the geometry and lateral extent of any adverse structure that could impact the stability of the rock cut. In our experience over the past several decades, 10 to 12 feet of excavated height and a slope length of approximately 50 to 100 feet have proved most effective for identifying the geologic structure while providing reasonable access for necessary stabilization work to be completed and allowing for reasonable excavation efficiencies.

The contractual requirements regarding the sequencing of the rock excavation and stabilization support for this project are very clear. The Special Provisions (page 219) of the contact states the following:

> "For new rock cuts, reinforcement shall be installed on each lift before the next lift is blasted or excavated. The lift height shall be 24 feet and the vertical reinforcement interval shall be 12 feet."

This is the point in the excavation where the contractor is required to stop the excavation and install slope reinforcement, prior to re-commencing excavation and/or blasting in the cut. This is also a convenient and less disruptive time in the excavation cycle in which to conduct the geotechnical lift inspections and the 12 foot high lift face provides an adequate area to visually inspect the slope.

The geotechnical construction support and the engineering recommendations provided by the Geotechnical Division to the project office is a geotechnical team effort. For a variety of reasons unilateral geotechnical decisions will typically not be made. Most importantly, we require that geotechnical recommendations and/or design modifications go through an internal review process. This can generally be done in an expedited manner utilizing the more senior members of the geotechnical team.

In addition, the geotechnical construction support that the Geotechnical Division provides are specialized geotechnical engineering services not intended to replace or circumvent the typical project inspection work provided by the project office.

## Contractor's Claims

The contractors' letters that were received on July 26th and July 27th revolve around issues and perceived delays in the Station 1337 vicinity rock cut. This was the only rock cut that the contactor was actively excavating at the time. The Station 1337 rock cut is part of a large continuous rock cut that extends back to Station 1316, a distance of approximately 2400 feet. Cut height in the Station 1337 cut are on the order of 85 to 90 feet. To address issues contained in these letters, into context, and to provide some perspective to those letters, we have developed a timeline of the contactors activities in this rock cut. The timeline is as follows:

**June 15, 2010 – Blast No. 1**
The contractor (Western States) shot preshear holes between Station 1336+30 and Station 1337+80 and a small pioneering blast to provide assess to the top of Lift No. 1.

**June 24, 2010 – Blast No. 2**
The contractor (Western States) shot a small pioneering blast in the vicinity of Station 1337+50 to provide safe access and a flat working area for the drilling of the production blast holes for Lift No. 1.

**June 28, 2010 – Blast No. 3**
The contractor (Western States) shot the first production shot of Lift No. 1 between Station 1336+54 and Station 1337+50. Estimated volume of the shot was 2800 cubic yards. The contractor utilized a 6 foot by 6 foot production blast hole pattern, and loaded those 3 inch diameter holes with 2.5 by 16 inch Magna Frac (stick explosives) cartridges.

**July 7, 2010 – Geotechnical Inspection**
Geotechnical personnel were on-site to review the upper portion of Lift No. 1 of Blast No. 3 which was shot on June 28, 2010. Upon arrival they learned that the lift had only been excavated approximately six feet. The excavation of the upper portion of the production blast had encountered a large number of oversize rock fragments ranging from 4 to greater than 6 feet in size. These oversize fragments had been drilled for secondary blasting (Norrish IDR – July 7, 2010).

**July 8, 2010 – Blast No 6**
The contractor (Western States) shot oversize boulders (secondary blasting) in the "muck pile" at the top of Lift No. 1 and the SRE stockpile area east of the Station 1337 rock cut.

**July 13, 2010 – Geotechnical Lift 1A Inspection**
The contractor (KLB) completed the excavation of the first 12 feet of the Lift No. 1, which was initially shot on June 28, 2010. Presumably the difficulties encountered with the shot rock excavation were due to poor fragmentation and the need for secondary blasting of large oversize material in the "muck pile". A geotechnical lift inspection was conducted on site starting at 8:00 AM between Station 1336+50 and Station 1337+20. During the lift inspection unstable wedges were identified in the exposed final slope face and 6 – 10 foot long and 2-15 foot long Type L rock dowels were field located to stabilize these wedges. In addition, 5 – 25 foot long pattern dowels were located near the base of the excavated lift (Mulhern IDR – July 13, 2010).

**July 14, 2010 – Rock Dowel Installation**
The contractor (NW Cascade) drilled and installed the Type L rock dowels that were field located on July 13, 2010. Observations by geotechnical personnel present on-site indicated that even though some of the dowels were located up to 8 to 9 feet above the base of the excavation lift, the contactor had no significant problems with these installations (Badger IDR – July 14, 2010).

**July 16, 2010 - Blast No. 8**
The contractor (Western States) shot free standing oversize boulders on the outside edge of Lift No. 1.

**July 19, 2010 – Blast No 9**
The contractor (Western States) shot a 10 foot deep perimeter shot (secondary blast) in the lower portion/outside edge of Lift No. 1. The volume of this shot was approximately 500 cubic yards.

**July 21, 2010**
The contractor (KLB), based on the project inspector's IDR, completed the excavation of Lift No. 1 to depth at around noon. The excavation lift at that point was approximately 4 feet short of the specified 24 foot lift height.

Although the project inspector's IDR discuss the need to contact the "Geotechs", the Geotechnical Division never received the call from the project inspector even though staff was available to conduct a lift inspection.

The IDR's also indicates that the drill and blasting subcontractor (Western States) was actively working on rock cuts on the west end of the project and the subcontractor (NW

Cascade) who installs the Type L rock dowels was actively working on installing soil nails immediately east of the Station 1337 rock cut.

**July 22, 2010 – Geotechnical Lift 1B Inspection**
A geotechnical lift inspection for the lower portion of Lift No. 1 was conducted on site in the morning between Station 1336+50 and Station 1337+25. The visual lift inspection revealed no significant geologic features in the form of wedges and planar type failures. One 10 foot long Type L rock dowel was located just above the bottom of Lift No 1 to stabilize a single rock block. In addition, 7 – 40 foot long pattern rock dowels were located near the base of the lift. These Type L rock dowels were lengthened from 25 feet specified in the contract, to 40 feet to intercept low angle adversely dipping planar features thought to exist behind the final back-slope of the cut at this elevation (Mulhern IDR – July 22, 2010). The anticipated presence of this low angle planar structure was based on on-going geotechnical analysis which has resulted in a stabilization design modification for subsequent excavation lifts to account for this geologic structure (Norrish - August 3, 2010 memo).

The project inspector's IDR indicates that the drill and blasting subcontractor (Western States) was drilling preshear holes in the western portion of the project near Station 1316 and the subcontractor (NW Cascade) who installs the Type L rock dowels was drilling soil nails of the second lift of the soil nail wall located immediately to the east. Ironically, the excavation contractor (KLB) was still excavating at the top of the Station 1337 cut. These activities were occurring after the alleged delay on July 21, 2010.

**July 23, 2010**
The contractor (NW Cascade) drilled and installed the Type L rock dowels that were field located on July 22, 2010.

The project inspector's IDR indicates that the drilling and blasting subcontractor had moved their drills from the Station 1316 area to the Station 1337 cut and had begun drilling preshear and production holes for Blast No. 12 which was scheduled to be shot on Wednesday July 28, 2010.

It should be noted that the blast plan for Blast No. 12 (Lift No. 2) was a significant departure from the Lift No 1 blast. The contractor (Western States) expanded it drill pattern for the production hole from the original 6 x 6 foot pattern to a wider 8 x 9 foot pattern and changed the type of explosive from 2.5 x 16 inch stick cartridges to poured ANFO. Although the contractor was delayed by equipment failures Blast No. 12 was shot on Thursday July 29, 2010. Post-shot review by the Geotechnical Division's blasting consultant indicated that the shot went well and resulted in much better fragmentation of the muck pile.

## Closure

The contactor's performance and production with regards to the Station 1337 vicinity cut, in our opinion, has been very slow at best. It has taken the contractor 39 calendar days to complete just one cycle of excavation **(drill → blast → excavate 12 feet → slope reinforce with rock dowels/rock bolts → excavate 12 feet → slope reinforcement with rock dowels/rock bolts)** for single 24 foot lift of the Station 1337 vicinity rock cut involving approximately 2800 cubic yards of material. It should be noted that the requirements for the excavation cycle have been defined contractually. Out of this 39 day effort, on the part of the contractor, only 2 days were required to install the 12 pattern Type L rock dowels as detailed in the contract plans and specifications and the 9 spot Type L rock dowels (as directed by the engineer) which were identified during our geotechnical field inspections of the exposed lift face. Based on the timeline provided above, we see no delays to the contractor in regards to our geotechnical activities on this project. Any delays/problems that occurred in this excavation cycle of this cut during the time period in question clearly lays with the contractors' methods to drill, shoot and excavate this portion of the cut. The question we would ask is how the production that has occurred in this portion the cut matches the contractor's submitted work schedule as a whole.

In the last 25 years the Geotechnical Division has provided geotechnical construction support on all large earth work and slope stabilization projects statewide. As examples, this includes 370 million dollars of slope stabilization work under the P3 Unstable Slope Program and the largest heavy earthwork project in the state - the 36 mile reconstruction of the Spirit Lake Memorial Highway. None of these construction projects required full time dedicated geotechnical staffing to provide the needed geotechnical construction support.

With regards to our geotechnical construction field support on the Phase 1B project (between June 10th and July 22$^{nd}$, 2010) we have been onsite 18 days (representing approx 48 % of the time) since June 10th when the contractor finally got going on the earthwork portion of this project. Most of this geotechnical construction support work involved assisting the contractor with confirming the depths of overburden, resolving survey monitoring instrumentation and instrument tower stability issues, blasting problems, and minor non critical geotechnical issues, etc. During that period of time we have only conducted two lift inspections (July 13th and July 22nd) both located in the Station 1337 vicinity cut (Lift 1A and 1B). It should be noted that given reasonable notification from the project inspectors our geotechnical staff can be on-site within two to three hours and have the geotechnical lift inspection completed within an hour or two. From our perspective this level of field involvement, in conjunction with our weekly teleconferences, has provided more than adequate geotechnical construction support coverage when you consider the contractors performance over the last month and half. Once the contractor resolved their problems and decides to ramps up their rock excavation work on the project, we fully expect to do the same with regards to our

geotechnical construction support activities on the project. This does not require a dedicated full time geotechnical staff on site, as requested by the contractor. We will respond to the project needs when geotechnical construction issues arise on the project, on an as needed basis, as we have done in the past on other WSDOT construction projects.

If you should have any questions concerning the contents of this memorandum, please feel free to contact Steve Lowell at (360) 709-5460, or Tony Allen (360) 709-5450.

TMA/SML
Attachments as Stated

cc: Tom Baker – State Materials Laboratory, 47365
Brian White – South Central Region, DOTSC
Derek Case – State Construction Office, 47354

KLB Construction

July 26, 2010

Kelly Griffith, Project Manager
Max J. Kuney Company
PO Box 4008
Spokane, WA 99202

Serial Letter # 52

Re: I-90 Hyak to Snowshed Vicinity Phase 1B Add Lanes and Bridges
WSDOT Contract #7852, KLB #210845

Subj: Notice of Change of Conditions – Additional Rock Bolts

Dear Mr. Griffith,

KLB Construction and it's subcontractors have incurred significant schedule delays due to the addition of multiple rock dowels near Stations 1336+00 and 1337+00. At approximately 11:00 AM on Wednesday KLB Construction had completed mucking the first bench of the excavation, there was approximately 8 vertical feet from the lowest row of rock dowels to the bench, as this is less than the 12' vertical pattern KLB Construction should have been able to proceed with the pre-split and production drilling of the next bench.

At that time WSDOT inspectors notified KLB Construction that additional rock dowels would be needed and that presplit drilling could not begin, however the inspectors could not dictate were the rock dowels were needed, so installation could not begin at that time. If the additional rock dowels had been marked on Wednesday, then they could have been installed on Thursday morning. But the geo-technical Engineers did not arrive on site until 9:00 AM Thursday. NW Cascade, the rock dowel subcontractor had no choice but to focus its efforts on other production work instead of being on standby waiting for the rock dowels to be laid out. Therefore rock dowel installation could not begin until Friday.

Western States intended to begin drilling pre-split at the second bench on Jenkins Knob on Wednesday at noon, but were delayed and could not start until Saturday morning, working costly over-time hours. The addition of theses rock dowels, and by not having the geo-technical engineers on site cost KLB Construction, Western States and NW Cascade a schedule delay of two and a half working days on the rock excavation.

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KLBCOI*15388

KLB Construction cannot afford a delay of two and a half days. KLB Construction requests that WSDOT compensate the contractor for the premium cost of over-time and double-time hours that will have to be worked to make up for this time loss. Indirect Costs and Schedule impacts will be evaluated as the project continues.

Please forward this notice to WSDOT.

Sincerely,

FOR:

Aiesh Ragih, Project Manager
KLB Construction, Inc.

KUNEY SINCE 1930
GENERAL CONTRACTORS
WA CONTRACTORS LICENSE KU-NE-YM-J 372 NO

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July 27, 2010

Will Smith
Washington State Department of Transportation
P.O. Box 12560
Yakima, WA 9890-2560

Serial Letter# 80-11
RE: Additional Rock Dowel
STA 1336

Dear Will:

Attached is KLB Serial letter #52 detailing delays due to the untimely addition of rock dowels at Jenkins Knob. KLB is reserving their right to request additional compensation for associated impacts to both cost and schedule.

This issue is primarily due to a lack of consistent geotechnical representation on the project. This lack of presence has adversely affected construction activities more than once. I am therefore requesting that a geotechnical representative be on site whenever work is progressing on the slope.

Please feel free to call if you wish to discuss this issue further.

Sincerely,

Kelly Griffith, P.E.
Project Manager